Description

Method for controlling the power consumption in an electronic appliance

The present invention relates to a method for controlling the power consumption in an electronic appliance and to a corresponding electronic appliance. In general, it is necessary to minimize the power consumption by battery-operated or storage-battery-operated electronic appliances. Many electronic appliances, such as computers or PCs (Personal Computers), laptops, PDAs (Personal Digital Assistants) or mobile telephones (mobile phones), have an interface for interchanging or for transmitting data, i.e. a data interface. At the same time, the addressability, i.e. the ability to use such a data interface for transmission, must not be impaired, remembering that the power consumption has been minimized. In addition, applications which control the electronic appliance, such as terminal programs or fax programs in the case of PC-based applications, need to operate without being matched to standardized interfaces and protocols.

It is thus an object of the present invention to provide a method and a corresponding electronic appliance which can be used to achieve a minimum power consumption without impairing the operation of the electronic appliance in doing so.

This object is achieved by an inventive method in accordance with claim 1 and by a corresponding electronic appliance in accordance with claim 5. Further advantageous embodiments are presented in the corresponding subclaims.

Claim 1 provides a method for controlling the power

consumption in an electronic appliance which has a data interface which is suitable for data transmissions, the method involving data transmissions which arise being monitored and registered and a power consumption in the electronic appliance being controlled on the basis of the registered data transmissions which arise.

This means that, in line with the invention, the power consumption within the electronic appliance is controlled using the volume of data in the electronic appliance.

It is known to date that a data interface provided in electronic appliances, such as in mobile radios, is not active when the electronic appliance is in a provided power-saving mode. Conversely, this means that the power-saving mode in the electronic appliance is permanently exited when the data interface has contact made with it or is activated. This means that once the data interface has been activated the electronic appliance is no longer automatically reset to the power-saving mode even after the termination of a data transmission, but rather remains in the state or mode which it adopted when the data interface was active. In the case of mobile telephones, for example, this results in up to six times the power consumption without data transmission. To date, the power-saving mode can be controlled only using special commands. According to GSM specification 3GPP TS 07.07 V7.7.0 (2001-12), a command called "AT+CFUN" disables the data interface in the electronic appliance and switches to the power-saving mode. Another change is that the presence of a cable connection is detected by the appliance using control lines. While the cable connection exists, the power-saving mode is exited and is resumed only when the data cable is removed, that is to say when the cable connection is interrupted.

There is also a known method for controlling the power consumption in a computer, where the computer comprises a data interface (a keyboard), a monitoring unit for monitoring and registering data (input controller) and a control unit, coupled to the monitoring unit, for controlling the power consumption. If the data interface is not transmitting any data (the user does not register any text), the control unit automatically (after a period of time) puts the computer into a power-saving mode. The power-saving mode is exited when the user presses a button.

US 6,018,232 discloses a computer having a receiver for receiving paging messages. The computer is first of all in a sleep mode. When the paging message has been received, the computer is switched to a standby state. Depending on the content of the paging message, certain programs can automatically be started in the computer's main processor.

US 2002/0035702 A1 discloses a method for automatically waking up a computer which comprises a modem, the computer being in a power-saving mode (suspend mode) first of all. When the modem receives a first signal, it sends a wake-up signal to the computer. The computer is now in a standby state. The modem now sends a second signal (e.g. an incoming fax) to the computer.

In line with the invention, mechanisms which are now introduced for data flow control within an electronic appliance are used to control a power consumption within the electronic appliance.

In one preferred embodiment of the inventive method, the data transmissions which arise are monitored and registered using control lines. Control lines are signal lines which indicate to a remote station

involved in the data transmission that the appliance can receive further data. If the electronic appliance is a GSM module, the data interface provided therein is in the form of a serial interface with control lines and is called an RS232 interface. For the RS232 interface, a control line of this type is known, by way of example, by the name "Clear to Send" (CTS), and for a printer interface it is known by the name "Acknowledge" (ACK).

In another preferred embodiment of the inventive method, data flow control is brought into action by commands, such as by control characters Xon/Xoff, which are contained in the datastream. This is also called software flow control.

In line with the invention, data flow control or monitoring and registering of the data transmissions which arise within the electronic appliance allows an application to use the data interface, or to transmit data via this data interface, cyclically. This means that the data interface is activated or can be addressed cyclically and is deactivated or can no longer be addressed only at the time at which the end of the data transmissions is registered.

Preferably, there is a power-saving mode into which the electronic appliance is put when no data transmissions are registered as arising and which the electronic appliance exits when data transmissions are registered as arising.

With particular preference, the electronic appliance is put into and/or taken out of the power-saving mode automatically. While the data interface is being used, the power-saving mode is exited. As soon as a volume of data is no longer detected or registered, the

electronic appliance automatically reverts to the power-saving mode.

One great advantage of the invention can be seen in that two independent methods which were originally introduced separately to an electronic appliance, namely a power-saving technology and data flow control, are effectively coupled to one another, in line with the invention, within an electronic appliance such that a power-saving method which is controlled by the volume of data within the electronic appliance has been developed.

In addition, the present invention provides an electronic appliance which has at least the following elements:

- a data interface for performing data transmissions,
- a monitoring unit for monitoring and registering data transmissions which arise,
- a control unit, coupled to the monitoring unit, for controlling and setting a power consumption on the basis of the registered data transmissions which arise.

Preferably, the data interface is in the form of an interface with control lines.

In another preferred embodiment of the inventive electronic appliance, the electronic appliance is a GSM module

In addition, a power-saving mode is preferably provided in the inventive electronic appliance. If the electronic appliance is in this power-saving mode, then the power consumption is at a minimum.

In a GSM module, the data interface provided therein is in the form of a serial interface with control lines. This interface is known by the name RS232 interface.

In the case of a GSM module, the data interface is provided cyclically on the basis of a "GSM paging cycle". The term "paging" involves an item of information for transmission from a base station in a mobile radio network which (information) needs to be communicated to the individual mobile stations as an item of system-specific information. In this case, the mobile radio network prescribes a period duration in which the GSM module can fetch information from the mobile radio network. The GSM module therefore exits the state with the lowest power consumption for a short time. In addition, a control line, a "Clear to Send" (CTS) control line, is used to signal to an application that the data interface is ready to transmit data. If events with a mobile termination are involved, for example, such as SMS or call setup, the GSM module automatically exits the state with the lowest power consumption, i.e. the power-saving mode, signals this using the control line "Clear to Send" (CTS) and, after the event, reverts to the old state, i.e. to the power-saving mode, unless the application sends data to the GSM module while the control line CTS is set. If this is the case, the GSM module does not adopt the state with the lowest power consumption until no more data are being received and a settable time, for example 2 seconds, has elapsed. In this case, the application requires no activities or adjustments, that is to say the GSM module's power-saving mode need neither be restarted nor exited using commands or control lines.

Further advantages are explained in more detail with reference to the figure below, in which:

Figure 1 shows a schematic illustration of the flow of one embodiment of the inventive method.

Figure 1 shows the flow of an embodiment of the inventive method for a GSM module. It shows the timing of a GSM paging cycle. As already described, the term "Paging" involves an item of information for transmission from a base station in a mobile radio network which (information) is in this case communicated to the GSM module as system-specific information in the form of a "Paging Message" using a period duration of 2.12s which is prescribed by the mobile radio network. The top portion of figure 1 shows the periodic transmission of the "Paging Message" in the form of a periodic square-wave signal. The bottom region shows a corresponding time profile for the enabling or addressability of a data interface in the GSM module, linked to a corresponding power consumption state. Looking at the timing in figure 1 from left to right, information is thus communicated to the GSM module using a first "Paging Message". In this case, the data interface in the GSM module is enabled and the GSM module exits the state with the lowest power consumption, i.e. the power-saving mode, and changes to a type of standby state with a higher power consumption, which in this case is shown in light grey shading. At the same time, a control line, namely a "Clear to Send" (CTS) control line, is used to signal to an application that the data interface in the GSM module is ready to transmit data. In the present example, an application (not shown here) then sends data to the data interface. The start of the transmitted data is called the "1st character" in this case, and the end is called the "Last character". On account of this, the data interface will remain in the standby state for a longer time. Only when no more data

are being received and a settable time, in this case 2 seconds, has elapsed does the GSM module readopt the state with the lowest power consumption, i.e. the power-saving mode, which is shown in dark shading in this case. When another "Paging Message" is sent by the base station, the GSM module exits the power-saving mode for a short time, in this case 20ms, and will revert to the power-saving mode again when no further data are being sent by an application. In this case, a short relaxation time of approximately 5ms elapses again. An application requires no adjustments.